one side, the 2 trout species at the other exhibit close similarities: While the herring and smelt show a single homomeric band (A) close to the start position, the 2 other homomers (B and C) migrating farther to the anode, the 2 trout species exhibit the homomeric bands A and B close to the origin, the C homomer migrating farther.

According to the diploid-tetraploid relationship established between members of the order *Isospondyli*, herring and smelt represent species on the diploid level, while the trout species have undergone tetraploidization during their recent evolution[20]. Thus, each of the 2 types of α-GPDH pattern coincides with one of the two ploidy levels. Since the number of gene loci in the diploids is apparently the same as in the tetraploids, the question of homology between the gene loci involved is of particular interest. Possibly the gene locus of the A isoenzyme was maintained in all species during evolution, whereas the loci of the B and C isoenzymes could have originated in different ways in the two groups of species. The 3 genes present could have arisen from a smaller number of ancestral genes through tandem duplication in the dipliods and through polyploidization in the tetraploids.

Addendum. The offspring of rainbow trout type ABC × type ABC' investigated meanwhile revealed the expected heterozygous pattern ABCC'. The confirms the existence of two alleles at the C locus of rainbow trout.

Zusammenfassung. Die Isoenzyme der α-GPDH lassen bei diploiden (Hering, Stint) und tetraploiden (Regenbogen-, Bachforelle) Fischen der Ordnung *Isospondyli* auf jeweils 3 verschiedene Genloci schliessen. Die stammesgeschichtlichen Beziehungen zwischen den verschiedenen Untereinheiten werden kurz diskutiert.

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Karyotypes of the Panamint Kangaroo Rat (*Dipodomys panamintinus* (Merriam))

Chromosomal polymorphism is not uncommon in mammals and has been reported by several authors (Baker and Mascarello[1]; Patton and Dingman[2]; Hsu and Arrighi[3]). Usually this takes the form of interpopulational rather than intrapopulational variation and points up the fact that describtion of the karyotype of a species should only be made after sampling at least all of the subspecies. This is particularly true if some of the subspecies are well isolated from one another.

In this light, we wish to report on the karyotypes of the Panamint kangaroo rat, *Dipodomys panamintinus* (Merriam). This species is divided into 5 subspecies (Hall and Kelson[4]): *leucogenys* and *mohavensis* which have a continuous distributrion; *argusensis* and *panamintinus* which are in doubtful contact with each other and probably were in recent contact with *leucogenys* and *mohavensis*; and *caudatus* which is isolated from the other 4 subspecies by extremely arid, low desert which is atypical of the habitat of this species (Figure 1).

The only reports of the karyotype of this species have been from *D. p. mohavensis* (Csuti[5]; Jackson and Hunsaker[6]). In this study, specimens were collected at or near the type localities of each subspecies. Karyotypes were prepared by the method of Patton[7]. The results are shown in the Table and Figures 2 and 3. Figure 2 shows a karyotype of *D. p. leucogenys* which is typical of the species. Figure 3 shows the karyotype of *D. p. caudatus* which is quite distinct from the other 4 subspecies. The diploid number is constant (64) in all subspecies and agrees with the number given by the other investigators. From our sample, the sex chromosomes appear to be the same in all subspecies, i.e., a metacentric *X* and a small metacentric *Y*. Csuti[5] found a small submetacentric *Y* and Jackson and Hunsaker[6] indicated a small metacentric as the *Y*. We differ in ratios of biarmed and uni-

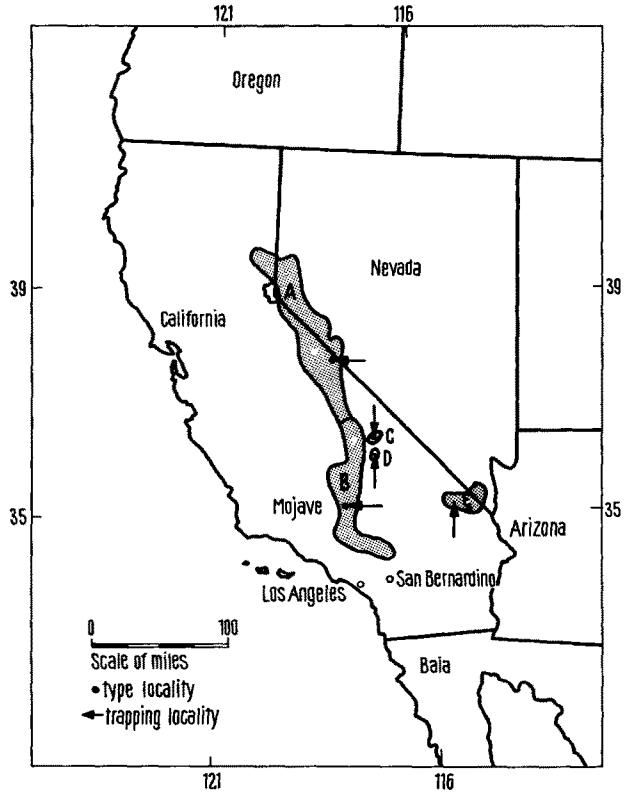

Fig. 1. Distribution of *Dipodomys panamintinus* and subspecies. A) *D. p. leucogenys*. B) *D. p. mohavensis*. C) *D. p. panamintinus*. D) *D. p. argusensis*. E) *D. p. caudatus*.

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[4] E. R. Hall and K. R. Kelson, *The Mammals of North America* (The Ronald Press Co., New York 1959), vol. 1.
[5] B. A. Csuti, Interrelationships of five species of Kangaroo rats (Genus *Dipodomys*) unpubl. MS thesis (1969).
[6] L. Jackson and D. Hunsaker II, *The Chromosomes in the Genus Dipodomys*, in press (1970).
[7] J. L. Patton and R. E. Dingman, Cytogenetics *9*, 139 (1970).

Fig. 2. Karyotype of *D. p. leucogenys* which is typical of the species (exept *caudatus*).

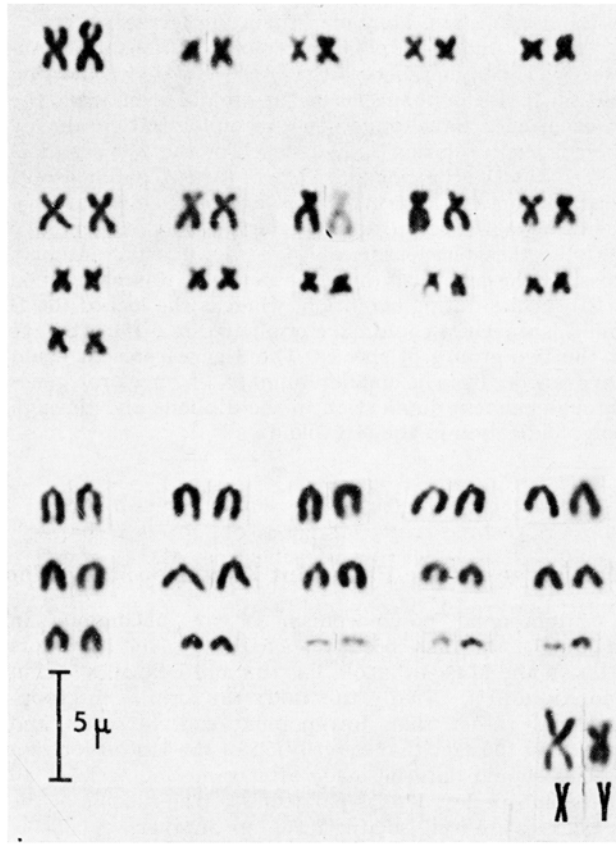

Fig. 3. Karyotype of *D. p. caudatus*.

Analysis of karyotype of the subspecies of *Dipodomys panamintinus*

Subspecies	Sample		Autosomes				Sex		
	M	F	2N	M	SM	T	FN	*X*	*Y*
D. p. argusensis	2	0	64	5	12	14	96	M	SM
caudatus	5	0	64	5	11	15	94	M	SM
leucogenys	1	3	64	5	12	14	96	M	SM
mohavensis	4	4	64	5	12	14	96	M	SM
panamintinus	5	5	64	5	12	14	96	M	SM

M, metacentric; SM, submatacentric; T, telocentric.

armed chromosomes. JACKSON and HUNSAKER reported 18 metacentrics and 13 acrocentrics for *mohavensis* which probably represents only a difference in the appearance of 1 acrocentric in their sample. CSUTI, however, reported 15 metacentrics and 15 acrocentrics for *mohavensis*.

We find that the species has 17 and 14 in all cases except *caudatus* in which we find a ratio of 16 to 15. Since *caudatus* is the most isolated of the 5 subspecies, this variation may have been caused by a pericentric inversion in 1 pair of small metacentrics which became fixed in this population. The lack of variation in the other 4 subspecies may argue for rather recent contact between those subspecies which now appear isolated. We would propose that the primitive karyotype of this species is 5 metacentrics, 12 submetacentrics, and 14 acrocentrics giving a fundamental number (FN) of 96.

Résumé. Le rat Kangourou *Dipodomys panamintinus* a 4 sous-espèces. Le représentatif karyotype de 4 des sous-espèces a 17 métacentriques et 14 chromosomes acrocentriques. *Dipodomys panamintinus caudatus*, géographiquement isolé des autres, a 16 métacentriques et 15 chromosomes acrocentriques. Le nombre fondamental est 96 pour les espèces.

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